Application of Near Infrared Reflectance Spectroscopy (NIRS) to develop prediction models for feed intake of dairy cows based on animal factors and faecal spectra

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Introduction

Prediction of feed intake based on faecal NIRS and its functional properties are well accepted as an alternative to laboratory chemical procedures. However, an addition of animal factors should improve the predictive accuracy of a model.

The objective of this study was to develop new simple prediction models for feed intake based on animal factors (BW, WOL) and faecal spectra.

Methods

Two year experiments (2006-2007) were carried out in Vietnam and France. Data (DM,UFL, PDI intake, and animal factors) of 1322 cows were collected. Corresponding fecal samples were scanned in a Near Infrared Spectrometry to collect samples' spectra. The faecal spectra were converted to scores using the PCA procedure.

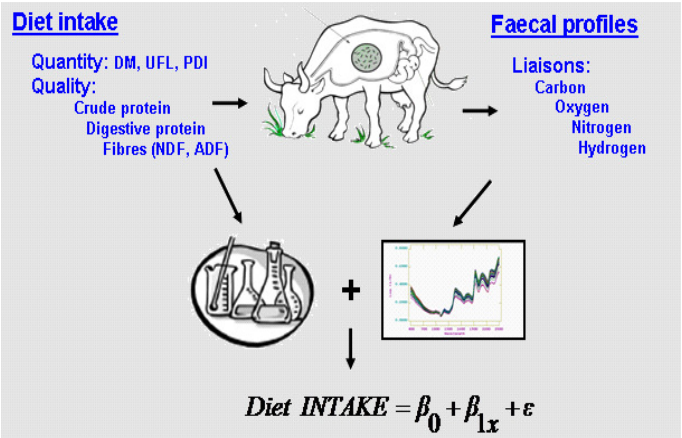

Figure 1. Prediction of feed intake using faecal NIRS analyse

The prediction models based on animal factors and/or faecal spectra, which were developed using PLS method, could be simply expressed as:

$$Pre\_INTAKE_{ij,\alpha} = \bar{\mu} + \Sigma a_i AF_i + \Sigma b_j SC_j + \gamma$$

Where: Pre_INTAKE is the predicted FEED INTAKE of animal α; a is the coefficient of animal factor AFi ; b is the coefficient of faecal score SCj ; γ is the residual error.

Results

Results showed that the models including both animal factors and faecal spectra obtained high accuracies.

Table 1: Main calibration and validation statistics of intake prediction models based on both animal factors and faecal spectra

Model	Calibration			Validation		
	MPE	RPE	PreR²	MPE	RPE	R²
DM intake	1.35	7.8	88	1.51	8.6	84
UFL intake	1.25	9.0	88	1.30	9.2	86
PDI intake	0.15	11.2	88	0.14	10.0	88

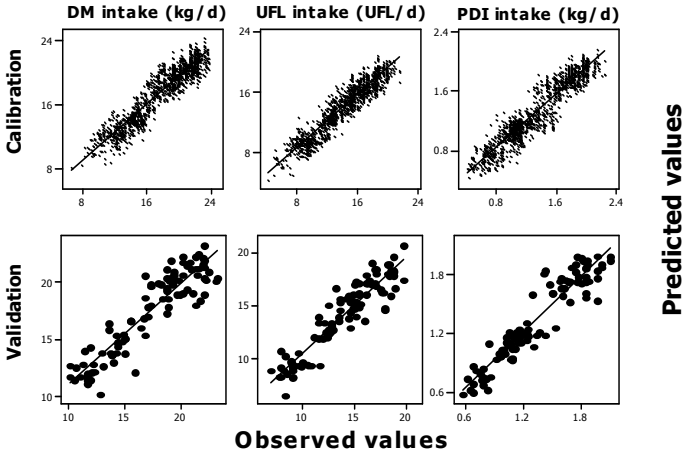

Figure 2. Regression fits of intake prediction models: calibration and validation

Conclusions

Faecal NIRS analysis is a rapid and easy method to estimate diet intake in dairy cattle. The models using both animal factors and faecal spectra provided high accuracy and high precision of prediction and could be applicable in many circumstances because of large variation in developmental data.